

**A***udit*



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DEFENSE MANUFACTURING TECHNOLOGY PROGRAM

Report Number 98-083

February 25, 1998

Office of the Inspector General  
Department of Defense

19990923061

DTIC QUALITY INSPECTED 4 AQ I 99-12-2405

## INTERNET DOCUMENT INFORMATION FORM

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**B. DATE Report Downloaded From the Internet:** 09/23/99

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**D. Currently Applicable Classification Level:** Unclassified

**E. Distribution Statement A:** Approved for Public Release

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19990923-061

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### **Acronym**

CoE	Center of Excellence
DLA	Defense Logistic Agency
DDR&E	Director of Defense Research & Engineering
GAO	General Accounting Office
JDL	Joint Director of Laboratories
MTIAC	Manufacturing Technology Information Analysis Center
TARA	Technical Area Review and Assessment

February 25, 1998

MEMORANDUM FOR DIRECTOR DEFENSE RESEARCH AND ENGINEERING

SUBJECT: Audit Report on the Defense Manufacturing Technology Program  
(Report No.98-083)

We are providing this audit report for review and comment. We performed the audit at the request of the Chairman, House National Security Committee.

DoD Directive 7650.3 requires that all recommendations be resolved promptly. The Director, Defense Research and Engineering did not comment on a draft of this report. Therefore, we request comments to the final report by April 27, 1998.

We appreciate the courtesies extended to the audit staff. Questions on the audit should be directed to Ms. Kimberley A. Caprio, Audit Program Director, at (703) 604-9139 (DSN 664-9 139), email <kcario@dodig.osd.mil> or Ms. Veronica McCain Acting Audit Project Manager, at (703) 604-9338 (DSN 664-9338), email <vmccain@dodig.osd.mil>. See Appendix B for the report distribution. The audit team members are listed inside the back cover.



David K. Steensma  
Deputy Assistant Inspector General  
for Auditing

## Office of the Inspector General, DoD

**Report No. 98-083**  
(Project No. 7CA-5025)

**February 25, 1998**

### Defense Manufacturing Technology Program

#### Executive Summary

**Introduction.** The audit was performed at the request of the Chairman, House National Security Committee, as a follow up to a 1992 General Accounting Office report. DoD established the Manufacturing and Technology Program in the late 1950s in response to a growing need for advanced production processes. The program focuses on defense essential needs that are beyond normal industry risk. The Manufacturing Technology Program is structured around three major thrust areas: manufacturing and engineering systems, process and fabrication, and advanced industrial practices.

The Director, Defense Research and Engineering, provides oversight for the Manufacturing Technology Program, and the Military Departments and Defense Logistics Agency are responsible for managing and executing projects that meet program goals. For FY 1996, Manufacturing Technology Program funding was approximately \$165 million for 14 centers of excellence, three demonstration centers, and 97 projects.

**Audit Objectives.** The objective of the audit was to evaluate the adequacy of program management and administration, and the effectiveness of the Defense Manufacturing Technology Program. We also reviewed the management control program as it applies to the audit objectives.

**Audit Results.** Overall, the ManTech program has realized some success in filling a need for DoD purposes that did not exist in industry. However, program implementation can be improved. Issues reported in the 1992 General Accounting Office report still exist. Specifically, the Director, Defense Research and Engineering can improve guidance and oversight. The Military Departments and Defense Logistics Agency can improve program management, methods for tracking project results, and identifying project benefits. In addition, the Manufacturing Technology program can improve accountability for levels of cost sharing, technology transfer, dual use program and mechanism to ensure CoEs are competed on a regular basis. Also the management control program could be improved because we identified a material weakness applicable to the audit objectives (Appendix A).

**Summary of Recommendations.** We recommend that the Director, Defense Research and Engineering, revise DoD Instruction 4200.15, "Manufacturing Technology Program," to clearly define selection criteria for manufacturing technology projects, outline roles and responsibilities of parties executing projects, establish guidance and performance metrics

for reporting program results, include criteria for cost sharing and define in-kind contributions, and establish a charter for the Joint Defense Manufacturing Technology Panel. We also recommend the Director review Centers of Excellence and prepare a justification showing why centers were not **recompeted** and develop a strategy to ensure the need for **recompeting** is routinely addressed. In addition, transfer ongoing completed project results to the Manufacturing Technology Information Analysis Center.

**Management Comments.** The Director, Defense Research and Engineering, did not comment on a draft of this report. Therefore, we request the Director provide comments by April 27, 1998.

# Table of Contents

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<b>Executive Summary</b>	<b>i</b>
<b>Part I - Audit Results</b>	
Audit Background	2
Audit Objectives	4
Implementation of the ManTech Program	5
<b>Part II - Additional Information</b>	
Appendix A. Audit Process	24
Appendix B. Report Distribution	27

## **Part I - Audit Results**



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## Audit Background

**Audit Justification.** The audit was performed at the request of the Chairman, House National Security Committee, as a follow up to U.S. General Accounting Office (GAO) Report No. GAOMSIAD-92-74, "Defense Industrial Base: DoD's Manufacturing Technology Program Needs Systematic Evaluation," March 12, 1992, (OSD Case No. 8923), (Appendix A). GAO reported that long standing problems with the Manufacturing Technology (ManTech) Program's central management information system had gone uncorrected, the program lacked goals, and cost savings and financial benefits attributed to ManTech projects were not reliable. The report recommended that the Secretary of Defense revise ManTech guidance to demonstrate how the Military Departments program would be used to evaluate the entire ManTech Program, and establish a system of controls designed to provide more assurance that the ManTech Program was effectively implemented. The Secretary of Defense concurred with the recommendations to revise the guidance, and partially concurred with establishing a system of controls. According to the Secretary of Defense, control problems resulted, to a large extent, from congressional earmarking of funds for projects that had no benefit or cost effectiveness.

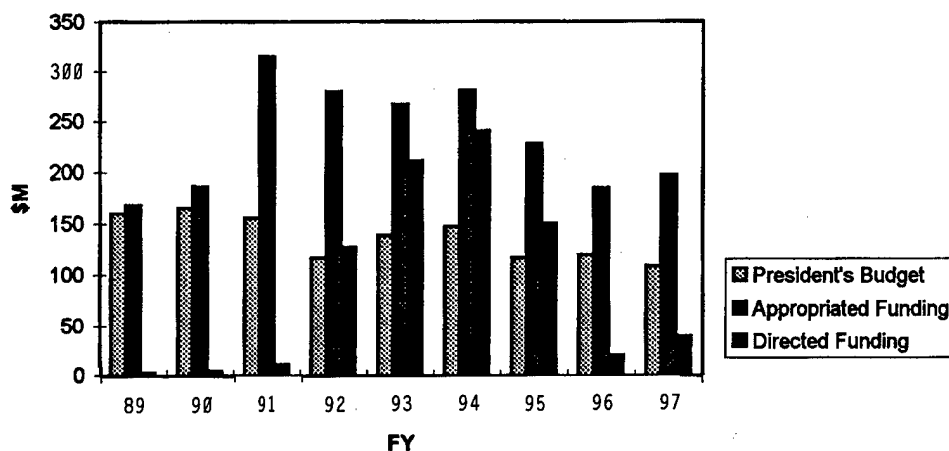
**Purpose of the ManTech Program.** DoD established the ManTech Program in the late 1950s. The objective of the ManTech Program is to develop advanced manufacturing technology that would allow DoD weapon systems to be produced faster, better, and at a lower cost. The program focuses on defense essential needs that are beyond the normal risk of industry and pervasive across industry sectors throughout the weapon system life cycle. ManTech funds are used to demonstrate the effectiveness and benefits of adapting commercial approaches to military needs. In addition, ManTech funds are used in projects for defense essential technology where market forces are not available to create mature manufacturing processes to support military product development and production.

**Management Responsibility for ManTech Program.** The Director, Defense Research and Engineering (DDR&E), within the Office of the Secretary of Defense, has oversight responsibility for the ManTech Program. Within DDR&E, daily oversight responsibility is assigned to the Staff Specialist for Manufacturing (ManTech Program Manager). The Military Departments and Defense Logistics Agency (DLA) are responsible for managing and executing projects that meet ManTech Program goals.

**Program Structure.** The ManTech Program is executed in various types of organizations, including contractors, industrial consortia, universities, and Federal agencies. The ManTech Program is accomplished through individual projects initiated and directly managed by the Military Departments and the DLA, and by projects delegated to Centers of Excellence (CoE). Individual ManTech projects are generally awarded to private contractors or CoEs by a Military Departments or

the DLA in support of weapon system requirements. **CoE** are set up in consortium type arrangements with industry, academia, and/or Government involved in developing and implementing advanced manufacturing technologies. The **CoE** also provide a focal point for developing and transferring new manufacturing processes and equipment with industry, academia, and **DoD** organizations.

**Program Funding.** We focused on FY 1996 for purposes of this audit. **ManTech** Program funding was approximately \$165 million for 97 individual projects, 14 **CoEs** and three demonstration centers. **ManTech** funding has varied since 1990 and large portions have been congressionally directed. However, in recent fiscal years directed funding has decreased. The following chart identifies **ManTech** funding from FY 1989 to FY 1997 showing requested, appropriated, and directed funds.



**Figure 1. ManTech Program Funding**

From 1992 to 1995, significant amounts (86 percent in FY 1994) of **ManTech** funds were earmarked at congressional request. While **DDR&E** was limited in deciding whether the project would be funded, **DDR&E** had the responsibility and discretion to determine if the project was completed, if deliverables were realized, milestones met, and if **ManTech** goals were achieved.

## **Audit Results**

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### **Audit Objectives**

The objective was to evaluate the adequacy of program management and administration, and the effectiveness of the Defense Manufacturing Technology Program. We also reviewed the management control program as it applies to the audit objectives. The audit process, organizations and individuals visited or contacted, and prior audit coverage are found in Appendix A.

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## Implementation of the ManTech Program

While the **ManTech** Program has realized some significant successes, program implementation can be improved. Specifically, the **ManTech** program can improve:

- adequacy and timeliness of guidance,
- adequacy of oversight and program management by **DDR&E**, the Military Departments and DLA,
- method used for tracking project results and identifying project benefits:
- adequacy of accountability for cost sharing, and
- effective use of competition.

As a result, **DoD** and congressional officials cannot be assured that funded projects are appropriate for the **ManTech** Program, **DoD** funds are expended efficiently, and the program is effective or realizing its goals.

## Background

**General Accounting Office Report.** In a 1992 report,<sup>1</sup> GAO stated that **DDR&E** had not established guidelines that would enable it to measure and evaluate **ManTech** Program effectiveness. In addition, GAO reported that long standing problems with the **ManTech** Program's central management information systems were still uncorrected, and cost savings or financial benefits being attributed to **ManTech** projects were not reliable. GAO recommended that the Secretary of Defense revise the system of controls designed to provide assurances that the **ManTech** Program is being effectively implemented. Such a system should include guidance to ensure that the Military Departments routinely and

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<sup>1</sup> Report No. GAO/NSIAD-92-74, "Defense Industrial Base: DoD's Manufacturing Technology (ManTech) Program Needs Systematic Evaluation," March 12, 1992, (OSD Case No. 8923).

## **Implementation of ManTech Program**

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uniformly report on the results of the projects measured against standardized criteria and their progress in meeting established program goals, priorities, and planned approaches.

## **ManTech Program Success**

**Success Stories.** The **ManTech** program has realized some significant successes in identifying and filling manufacturing needs for **DoD** purposes that did not exist in industry. These successes have resulted in the development of United States-based industries and helped to ensure the existence of needed manufacturing capabilities for **DoD**. Some success examples include the following projects.

- The Center for Optics Manufacturing, an Army-funded **CoE** located in Rochester, New York, developed a means to automate the formerly labor-intensive optical grinding process. The **OPTICAM**<sup>®</sup>, a computerized machine, performs microgrinding and polishing for precision optics more accurately, efficiently and faster than the conventional labor intensive methods. According to the project manager, 17 companies (70 percent small business) are now using the machines to produce 95 percent of **DoD** optics with projected cost savings of about \$10 million a year. Further development by the **CoE** reduced the cost of the **OPTICAM**<sup>®</sup> from approximately \$700,000 per unit to \$250,000.

- The Air Force Wright Laboratory initiated a project under contract to United Technologies Corporation to improve the aircraft paint stripping process. The Large Aircraft Robotics Paint Stripping program resulted in an automated low-cost, paint stripping system to replace the manual chemical stripping operations. The process reduced hazardous waste by 94 percent, eliminated 135,000 gallons of chemical stripper annually and reduced production hours by 50 percent. One Large Aircraft Robotic Paint Stripping system at the Oklahoma City Air Logistics Center saved \$4.6 million annually. In addition, this program was a joint initiative with the Navy that demonstrated high-pressure water coating removal for ships and submarines.

- The Navy initiated a project through the Laser Application Research **CoE** to develop a program that quantified the capabilities of laser beam welded panels. The program was designed to decrease the life-cycle cost by approximately \$300 million for repairing Navy hatch covers, jet blast deflectors, decks, ramps, elevator platforms, and hanger doors over a 6-to 8-year period. The project demonstrated the welding of lightweight structures through the use of laser technology on the U.S.S. Mt. Whitney. The laser design was documented as providing a weight savings of over 20,000 pounds on one ship compared to the

conventional stiffened-plate design. The laser core platforms have performed as expected in the marine environment, without experiencing corrosion problems or requiring extensive maintenance.

### Improvements Still Needed

Despite these, and other success stories, improvements are still needed in guidance and oversight of the **ManTech** Program. Issues reported by GAO in 1992 still exist. Specifically:

- **DDR&E** needs to provide additional guidance and oversight.
- **DDR&E**, the Military Departments, and DLA can improve program management.
- **DDR&E** continues to lack an adequate methodology to track **ManTech** project results and **identify** program benefits.
- **DDR&E**, the Military Departments and DLA can improve accountability over cost sharing.
- The Military Departments and DLA need to continuously reevaluate the need for **CoEs** and improve the use of competitive procedures in awarding **CoEs**.

In addition, **DDR&E**, the Military Departments, and DLA can improve the sharing of technology developed within the **ManTech** program with the commercial sector via technology transfer.

### ManTech Program Guidance and Oversight

**DDR&E** believes it has guidelines and delegations of authority in place that are adequate to provide management and oversight of the **ManTech** Program addressing the 1992 GAO concerns. These efforts include:

- a **DoD** instruction that is supplemented by **DDR&E** policy memorandums,

## Implementation of ManTech Program

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- an annual Defense Technology Area Plan,
- establishment of a Joint Director of Laboratories Manufacturing Science and Technology Panel (JDL) and subpanels, and
- annual Technical Area Review and Assessment (TARA).

DDR&E relies largely on these initiatives to provide overall **ManTech** Program guidance and oversight. The Military Departments and DLA are to provide detailed program guidance on daily direct program management and oversight because **DDR&E** has a one-person staff to oversee the **ManTech** Program. However, despite these initiatives, the **ManTech** Program indicates that **DDR&E**, the Military Departments, and DLA can improve the quality and extent of guidance and oversight.

**DoD Instruction.** DoD Instruction 4200.15, "Manufacturing Technology Program," May 1985, provides the basic guidelines for the **ManTech** Program management and reporting. Specifically, the instruction establishes the procedures for submitting project information into a centralized database system and submitting annual reports to **DDR&E**.

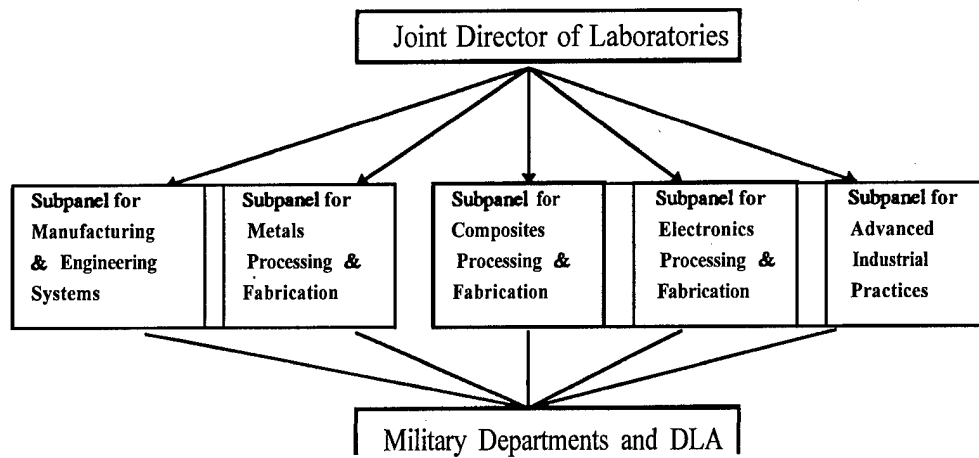
**Defense Technology Area Plan (the Plan).** The **DDR&E** **ManTech** Program Manager stated that **DDR&E** provides the Military Departments and DLA overall **ManTech** program direction within the Plan. The annual plan started in FY 1996. The Plan identifies the overall **DDR&E** vision for the year including broad goals and objectives for various **DDR&E** programs, including **ManTech**. For example, FY 2000 goals for **ManTech** projects include improving affordability, flexibility, and reducing development cycle time for military products. Specifically, **ManTech** projects need to focus on tools and methods that can bring 50 percent reductions in design and development costs and cycle time in a military product environment. The goals identified in the Plan are accomplished through projects executed by the Military Departments and DLA.

**Joint Director of Laboratories Manufacturing Science and Technology Panel (JDL).** In 1993, **DDR&E** established the JDL to assist with program oversight. The JDL included representatives such as **DDR&E** Program Manager, Military Departments Program Managers, industry experts (independent of **ManTech** projects), and DoD Component representatives (i.e., DLA and Defense Advanced Research Project Agency). The JDL established subpanels that focused on five major areas including metals, composites, electronics, advanced industrial practices, and manufacturing and engineering systems. The JDL subpanels were comprised of technical experts from the Military Departments, DoD Components, and industry experts.

## Implementation of the ManTech Program

- The entire JDL meets quarterly to plan and develop strategies and direction to execute the **ManTech** Program. Specifically, they receive an overview of **ManTech** projects from each JDL **subpanel** chairperson and provide comments to the chairperson on program strategy and direction. In addition, the JDL assists with leveraging **funds** and technology transfer.

- The JDL subpanels meets five or six times per year. Specifically, project managers brief the subpanels on existing **ManTech** projects. Projects are evaluated for affordability, dual use, sustainment, jointness, **DoD** requirements, beyond normal industry risk, implementation plan, and benefits/payoffs. Subpanels provide feedback to the project managers on adequacy of project management and possible duplication. In addition, the subpanels use this information to brief the JDL. The following figure identifies the relationship of the JDL, subpanels and **DoD** components prior to September 1996.



**Figure 2.** JDL Oversight Structure

In September 1996, the Chairman of the JDL, the Director of **DoD** Science and Technology, and the Chief of Naval Research decided to dissolve the JDL, stating that the JDL and subpanels had evolved into the Defense Science and Technology Reliance planning process. However, according to the **DDR&E ManTech** Program Manager, to reflect congressional guidance, the JDL continued functioning and was renamed the Joint Defense Manufacturing Technology Panel. In January 1997, **DDR&E** began the process of developing a charter for the Joint Defense Manufacturing Technology Panel.

**Technical Area Review and Assessment.** In 1995, **DDR&E** initiated the annual **TARA**. The **TARA** was conducted by a panel of **DDR&E** and industry representatives who reviewed a sample of existing **ManTech** projects presented by the Military Departments and DLA. A portfolio of **ManTech** projects are reviewed for completeness, balance, relevance, transition plan and unnecessary



## Implementation of ManTech Program

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duplication with other DoD programs. The TARA provides DDR&E the opportunity to determine the status of recommendations resulting from the previous TARA cycle, the status of issues identified by the Defense Science and Technology Advisory Group, and to provide information needed to defend the budget to Congress.

**Extent of Military Departments and DLA Guidance and Oversight.** DDR&E relies extensively on the Military Departments and DLA to perform daily program management and oversight of the ManTech Program. They identify, prioritize, and fund projects that meet ManTech Program goals and objectives. A review of program execution by the Military Departments and DLA indicated that, overall, each organization had a project review process in place, however, the processes were inconsistent.

**Army ManTech Program.** For FY 1996, the Army ManTech Program received approximately \$23 million to fund two CoE and 33 individual projects (non-CoE). The Army generally funds smaller projects that are focused on resolving specific problems rather than broad based technological needs. For the period of our review, the Army identified and selected ManTech projects by the major commands submitting proposals to the Army ManTech Program Manager, who along with commodity area managers, selects which projects will be funded. The Army instruction AR-700-90, "Army Industrial Base Program" April 1, 1992, provides service level implementation guidance for the ManTech Program. For FY 1998, the Army has revised the process for selecting and prioritizing projects and will focus funding more projects with broad based technology efforts.

**Navy ManTech Program.** The Navy received approximately \$86 million in FY 1996 for the ManTech Program to fund 11 CoE and 28 individual projects. The Navy accomplishes the majority of its ManTech efforts through the CoE as compared to the Army and Air Force which emphasize individual projects rather than CoE. The Navy generally funds projects that are focused on specific Navy problems versus broad based technology. The Navy identifies ManTech projects by having the system commands and industry identify requirements and submit them to an Executive Steering Committee. The Executive Steering Committee and the Navy Project Manager prioritize and select which projects will be funded. The Navy Manufacturing Technology Requirement Document outlines the process for determining and assessing Navy ManTech requirements. The Navy has a small staff available for program management.

**Air Force ManTech Program.** The Air Force received approximately \$53 million in FY 1996 to fund 36 individual projects. The Air Force has a Manufacturing and Technology Directorate that includes full-time staff responsible for managing the program. In addition, the planning process for the program is documented in the Air Force Manufacturing Science and Technology Program handbook. Air Force projects address areas in avionics, spacecraft, airframe, engines and sustainment as well as broad based technology development. The Air

Force identifies and selects projects for the **ManTech** program by having a requirements team assess customer needs and a planning team propose projects to address those needs. The proposals are forwarded and approved by the Manufacturing Technology Executive Group.

**DLA ManTech Program.** DLA received approximately \$4 million to support three demonstration centers and various metalcasting projects. A demonstration center is similar to a **CoE** in that it is structured in a consortium type arrangement with industry and university developing and implementing advanced manufacturing technologies. DLA has a small management staff that provides limited reviews of projects being implemented at the demonstration centers. For the apparel research network demonstration center, DLA relies mainly on industry for project proposals. DLA reviews projects proposals and decides which projects will be funded. We did not review the project planning process for the remaining demonstration centers.

**Need for Improved Oversight and Guidance.** While **DDR&E**, the Military Departments, and DLA have initiatives in place to provide oversight and guidance to the **ManTech** Program, the guidance is not adequate or consistent, the lines of responsibility are not clear, criteria for identifying and evaluating project results are not clear, and support for program accomplishments is not readily available.

**Guidance.** As stated previously, the primary guidance for **ManTech** program managers is the **DoD** instruction and the Plan. The **DoD** instruction, however, has not been revised since 1985 and the procedures are no longer valid. For example, the centralized database system no longer exists and the annual reports are no longer used to assess program management. In addition, the guidance lacks criteria for evaluating proposed **ManTech** investments to ensure they are defense essential and beyond the normal risk of industry, that projects are transferred to industry, or that the projects meet the congressional goals of competition or cost sharing. The Plan provides only broad goals and objectives for the **ManTech** Program and other **DDR&E** programs.

To ensure that **ManTech** funds are used for projects consistent with **ManTech** objectives, **DDR&E** needs to establish guidance that:

- defines criteria for selecting **ManTech** projects, including what constitutes an “essential **DoD** manufacturing capability,”
- outlines the process for evaluating project effectiveness and steps to perform the evaluations,
- establishes guidelines and performance metrics for reporting program results, and identifies the type of documentation needed to support that the technology has been transferred to industry,

## **Implementation of ManTech Program**

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- includes criteria for cost sharing and validation efforts to be taken to determine whether those goals have been met,
- outlines criteria for competition, and
- clearly defines the roles and responsibility of Military Departments and DLA **ManTech** Program Managers.

**Oversight.** DDR&E has various ways to provide oversight to the **ManTech** program including the **TARA** and the military **ManTech** Program Managers. The **TARA** reviews ongoing projects by both the Military Departments and DLA. However, the **TARA** meets once annually and reviews only a sample of **ManTech** projects. DDR&E needs to provide better oversight guidance, and clearly define the responsibilities of the Military Departments and DLA Program Managers. These steps are necessary to make the best use of increasingly limited staff for oversight purposes. DDR&E should place controls over the program, particularly funding, to ensure that those that do not comply are not provided funding until remedial actions are taken.

**Impact of Limited Guidance and Oversight.** As a result of the limited guidance and oversight, the Military Departments and DLA interpreted **ManTech** program goals differently, and funded projects that did not meet **ManTech** program goals, or that did not comply with **TARA** recommendations. In addition, there is no standardized criteria to evaluate **ManTech** projects, and that there is no way to determine whether projects were effective. It should be noted that projects funded directly by the Military Departments appeared to more closely meet **ManTech** goals, to address defense-essential manufacturing needs beyond the normal risk of industry. Projects identified as questionable were generally performed by the CoEs.

**Projects Not Meeting ManTech Goals.** The following are examples of projects that do not meet **ManTech** program goals because they do not constitute a defense-essential manufacturing need and did not benefit the **ManTech** program. DDR&E needs standard evaluation criteria to ensure that proposed **ManTech** projects are consistently evaluated for compliance with program goals and objectives.

- In FY 1996, the Navy provided approximately \$3 million to the Best Manufacturing Practices CoE, College Park, Maryland, to publish organization surveys of manufacturing practices based on information volunteered by each organization. Surveys of hotels and public school systems were included. Since hotels and schools are not traditionally considered to be manufacturing facilities, we question the applicability of these projects to improving defense-essential manufacturing capabilities beyond the normal risk of industry.

## Implementation of the ManTech Program

When we discussed our concerns with the Navy, they were unable to show adequate support on how such surveys were essential to the ManTech program or DoD.

- DLA paid Georgia Technology Research Corporation approximately \$162,000 to develop an information management system for ordering, tracking, and shipping in a quick response environment. While such a system may improve the contractor's capability to respond to DoD procurement orders, we question whether this project should be ManTech funded because the project did not meet a defense essential need, and is not outside the scope of commercial practices to improve efficiency or too great a risk for industry.

- The Navy contributed approximately \$152,000 toward a study conducted at the Gulf Coast Regional Maritime Technology Center, New Orleans, Louisiana on "Motion Sickness and Anti-Motion Sickness." The study focused on the relationship between motion sickness and personality. Although the study was not a ManTech initiative, the funds contributed for the project could have been put to better use.

- DLA initiated a project at Clemson University Apparel Research Network to manufacture dress blouses for women. While the particular blouse design is not standard, we question whether ManTech funds should be used to manufacture blouses.

We also identified CoEs that appeared to have similar functions that could possibly be merged.

- Both the Army and Navy fund CoEs that address gear manufacturing. In FY 1996, the Navy paid approximately \$2.1 million to the National Center for Advanced Drivetrain Technologies CoE to develop innovative and affordable gear and transmission technologies for military and defense-industry applications. Concurrently, in FY 1996 Congress earmarked \$4 million to the Instrumented Factory for Gears CoE to develop and demonstrate improvements for all manufacturing processes involved in gear production. According to the Army and Navy, the goals of the two centers differ. The Navy center emphasizes research and development of new manufacturing technologies while the Army center focuses on improving existing manufacturing methods. In addition, a memorandum of understanding has been established between the two CoEs to cooperatively pursue program goals and objectives.

**Projects Contrary to TARA Recommendations.** As part of the TARA, DDR&E provides the Military Departments and DLA with feedback and specifically addresses areas of improvement in program management. During TARAs, the Deputy of DDR&E has continuously emphasized to the Military Departments and DLA that many ManTech projects are too small to have a significant impact and that projects need to address a more broad based pervasive

## **Implementation of ManTech Program**

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need. Given this feedback, Military Departments and DLA should tailor their **ManTech** Programs accordingly. However, the Military Departments continue to fund small projects with limited impact, and often lump small projects under one title giving the impression that projects are for broad based technology. For example, the Army **ManTech** project "Energetic Materials Technology," valued at approximately \$3.3 million, consisted of five small projects that varied from developing automated systems to renovating buildings for research and development work. Specifically, the projects were designed to accomplish the following goals.

1. Develop and demonstrate a fully automated continuous processing system for manufacturing gun propellants.
2. Renovate buildings to support research and development for projects such as explosive compositions.
3. Conduct a study to assess the cost, producibility and environmental benefits of producing various propellant mixtures.
4. Develop a process that would reduce the production cost of the minefield safety net. The minefield safety net is designed to clear a minefield lane large enough for a tank to breach.
5. Develop a safe, environmentally acceptable and affordable liquid propellant manufacturing process.

## **Identifying and Reporting ManTech Program Benefits**

DDR&E is responsible for providing DoD and Congress with reasonable assurance that the **ManTech** program is effectively implemented and results are achieved. Congress identified the need to improve measures of program effectiveness, validate cost savings, and increase the transfer of manufacturing technologies to industry. This should include establishing criteria ensuring that projects are completed in a timely manner, are achieving the projects' objectives, have deliverables, result in technology transfers to industry, are of benefit to the war-fighter, and that cost savings or other demonstrable benefits are achieved. In addition, performance metrics should be used to measure project results.

**DDR&E Level Reviews.** According to DDR&E, the TARAs provide reasonable assurance that the Military Departments and DLA are effectively implementing the **ManTech** program. Our review of the TARA showed that it lacked information needed to assess the effectiveness of the program. For example, the reviews do not include overall **ManTech** program metrics, such as number of projects started

or completed, milestones for ongoing projects, estimated or actual project costs, total number of projects transferred to industry, and actual cost savings and other benefits realized. This type of information is essential when assessing the effectiveness of the program. Prior to 1995, the Military Departments were required to report project information in a centralized database. However, **DDR&E** discontinued this practice in March 1995 because of complications with the system. **DDR&E** needs to establish a standardized system for tracking projects that minimally identifies: project start/end date, milestones, need for the project, estimated/actual costs, projects transferred to industry, and benefits realized. In addition, **DDR&E** needs to issue guidance to the Military Departments and DLA regarding reporting requirements, how to determine performance measurements and cost savings/avoidance, and any other relevant criteria. **DDR&E** should also perform reviews of the reported information to validate that ManTech funds are expended appropriately.

**Component Level Reviews.** Project benefits (cost savings, labor reductions, etc.) were not adequately supported for 21 projects and 10 CoEs. For example, the Air Force, CoE, National Center for Manufacturing Sciences provided a report showing potential benefits for projects. However, the CoE was unable to provide supporting documentation showing the computations of the potential benefits and whether project benefits were realized.

**Performance Metrics.** The ManTech Program needs to improve performance metrics. Performance metrics allow the program to be evaluated through objective measurement and systematic analysis to the extent the program achieves the intended objectives or goals. The Government Performance and Results Act of 1993 holds Federal agencies accountable for achieving program results. In accordance with TARA recommendations, the Joint Defense Manufacturing Technology Panel has put a process in place to establish technology metrics for ManTech projects. However, the process needs improvement to identify performance metrics, such as return on investment, for the entire program and CoEs.

## **Cost Sharing**

The intent of the ManTech Program is to bring new technology into manufacturing, and to leverage ManTech Program funds with other government and industry resources to achieve the defense-essential manufacturing capabilities required. This is accomplished through cost sharing. Cost sharing occurs when

## **Implementation of ManTech Program**

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industry shares in the cost of a project either through cash or in-kind contributions. In-kind contributions may include the contribution of supplies, material, or personnel by the industry participant.

**Cost-Sharing Guidance.** The FY 1995 National Defense Authorization Act stated that a grant, contract, cooperative agreement, or other transaction may not be entered into under the ManTech Program on any basis other than cost sharing, unless the Secretary of Defense determines that the grant, contract, cooperative agreement is for a program that :

- is not likely to have any immediate and direct commercial application; or
- is of sufficient high risk to discourage cost sharing by non-Federal Government sources.

The FY 1996 Defense Authorization Act went a step further and required that at least 25 percent of the funds available for the ManTech Program each fiscal year be used for awarding grants and entering into contracts and cooperative agreements under which the ratio of recipient cost to Government cost is two to one. If the cost sharing requirement cannot be met by July 15 of the fiscal year, the Under Secretary of Defense for Acquisition and Technology may waive the requirement. Rationale for waivers must be submitted to the Senate Committee on Armed Services, and the House Committee on National Security. DDR&E provided the Military Departments with a copy of the FY 1995 National Defense Authorization Act, along with instructions on how to report cost sharing to DDR&E. The instructions stated that cost sharing may include both cash and in-kind contributions.

**Cost-Sharing Reports.** For FY 1996, the Military Departments and DLA provided DDR&E with reports of cost sharing for new awards. According to the Military Departments and DLA, for FY 1996, new awards totaled \$8.8 million, with \$3 million (34 percent of new awards) using two to one cost sharing. For FY 1997, the Military Departments and DLA reported new awards totaled \$34.2 million, with \$9.5 million (27 percent of new awards) using two to one cost sharing.

**Accounting for Cost Sharing.** Overall, the Military Departments and DLA were identifying cost sharing. The majority of the Military Departments cost sharing was through in-kind contributions, however, the Military Departments could not adequately support the value. For example, of the 10 CoEs reviewed, we identified only one CoE that maintained records showing the value of cost sharing through in-kind contributions. The remaining nine CoEs stated that cost sharing was received, but they were unable to support the dollar value for claimed in-kind contributions. DDR&E needs to provide additional guidance to the Military Departments and DLA on what is considered an acceptable in-kind contribution as well as necessary documentation requirements. The cost sharing requirement

should be similar to those for other transactions and precludes counting prior research costs and funds from other Federal programs. In addition, DDR&E needs to monitor whether the Military Departments and DLA can support reported cost sharing amounts.

## Use of Competition

**Competitive Requirements for ManTech Program.** Federal Acquisition Regulation part 6, "Competition Requirement," states that contracting officers shall promote and provide for full and open competition in soliciting offers and awarding Government contracts. The FY 1995 National Defense Authorization Act stated that competitive procedures shall be used for awarding all grants and entering into all contracts, cooperative agreements, and all other transactions under the ManTech Program.

**Extent of Competition Used.** The use of competition under the ManTech Program varies. We evaluated the extent of competition for projects awarded directly by the Military Departments and DLA, projects awarded to the CoEs, and the awarding of contracts, grants, and cooperative agreements to the CoEs for the operation of the CoEs.

**Military Departments Awarding Projects.** For the 21 projects reviewed that were awarded directly by the Military Departments and DLA, 15 were awarded competitively and 6 were awarded sole source. Justification for awarding sole-source projects was that the organizations completing the work were the only ones with the experience and expertise. For example, a sole-source contract was awarded for the development of a gun propellant mixture stated that there was no other United States source for this essential DoD process. The justifications appeared reasonable.

**CoEs Awarding Projects.** Projects awarded to the CoEs were accomplished in multiple ways. The projects were subcontracted to other companies or organizations, performed by the CoE directly, or performed under a consortium arrangement that included the CoE and industry partners. Once the projects were awarded to the CoEs, however, project accomplishment was left to the discretion of the CoE. At that point, DoD no longer controlled competition.

**CoE Awards.** Contracts, grants, and cooperative agreements were awarded competitively to establish the 10 CoEs. However, of the 10 CoEs reviewed, two CoEs were not being recompeted after the initial contract, grant, or cooperative agreement was awarded. Because timeframes had not yet expired on the remaining eight CoEs, we did not review them for competition. For example, the Air Force initially awarded a grant to the National Center for Manufacturing



## **Implementation of ManTech Program**

Sciences in Ann Arbor, Michigan, in 1986 at the direction of Congress. The Center has not been recompeted since its establishment and continues to receive congressional earmarks. In addition, the CoE for Composite Manufacturing Technology in Columbia, South Carolina, established by the Navy in 1990, has not been recompeted since its establishment.

**Adequacy of Competition for CoEs.** The intent of competition is to ensure that DoD obtains needed goods and services at a reasonable price. Officials in DDR&E, the Military Departments, and DLA responsible for awarding ManTech Program contracts, grants, and cooperative agreements, need to reevaluate and improve the use of competitive procedures. However, the Military Departments and DLA find it difficult to **recompete** five CoEs because they were established by Congress, and continue to receive congressional earmarks.

## **Technology Transfer and Dual-Use**

The ManTech program is driven by DoD needs for technologies and systems that provide a superiority edge to the war-fighters. These technologies may be beyond the normal risk level acceptable to industry or may not have an initial commercial application. Declining DoD budgets have rendered traditional, defense-essential approach to technology development and procurement less affordable and less effective than in the past. Thus, it is critical that DoD programs take advantage of cost-conscious, market-driven, commercial production and leverage to the maximum extent, and share those huge investments in new technology developed within ManTech with the commercial sector. This can be accomplished via technology transfer and the development of dual-use technologies.

**Technology Transfers Related to ManTech.** The ManTech program relies on a variety of mechanisms to disseminate and share the technologies it develops, including encouraging industry consortia and teams to perform projects, conducting end-of-project demonstrations, holding workshops and conferences, or relying on the CoEs to transfer the technology. In addition, DDR&E hosts an annual Defense Manufacturing Conference that provides a forum for presenting and discussing current and future projects, and the Military Departments and Defense agencies make technical reports available through the Manufacturing Technology Information Analysis Center (MTIAC).

**Existing Technology Transfer Efforts.** The annual Defense Manufacturing Conference provides an excellent opportunity for advertising and demonstrating ManTech related technologies. The 1996 conference was attended by 800 industry and Government representatives and included 70 exhibits sponsored by industrial corporations, industry associations, and CoEs. Technical sessions or

symposia were conducted in areas such as metals, composites, advanced industrial practices, and munitions.

**Opportunities for Improving Technology Transfers.** The MTIAC was established in 1984 to serve as a central source of information on Defense-related manufacturing technologies for both Government and the private sector. According to the **DDR&E ManTech** Program Manager, the MTIAC no longer maintains **ManTech** data, either as a list of **ManTech** projects or reports from completed projects. **ManTech** projects have not been updated in the MTIAC database since early 1990 because the system was not user friendly, and the Military Departments were not periodically updating information. The MTIAC will, however, provide someone inquiring about a **ManTech** project with a point of contact where work is being performed.

The **ManTech** program and resultant projects are a major portion of the DoD efforts to identify manufacturing technologies useful to DoD. Therefore, both **ManTech** projects current and past, as well as the results of those projects, should be available from the MTIAC. The Director, DoD **ManTech** program, and the Program Manager of the MTIAC should establish mechanisms to maintain, as well as, make such information available to interested parties.

**Dual Use Efforts Related to ManTech.** Dual use technology has become a key component in DoD investment strategy to make better use of funds while maintaining weapon system performance superiority and affordability. The intent of dual use efforts is to leverage off commercial technology at the R&D level to increase affordability, performance, and sustainability of military equipment. The plan, similar to **ManTech**, is to conduct these projects on a cost sharing basis between DoD and industry. The dual use program can complement the **ManTech** Program by not only identifying manufacturing technologies that are more efficient and cost-effective, but by looking first to the private sector for technologies that already exist, and leveraging off them, rather than funding their redevelopment for the military sector.

As an example of dual use capabilities already incorporated into the **ManTech** Program, the Air Force Military Products from Commercial Lines pilot program is demonstrating the commercial manufacturing of military electronic modules. Rather than being produced on a dedicated military line, tactical tighter and advanced helicopter electronics boards will be produced on a commercial automotive manufacturing line.

**DDR&E** should evaluate the possibility of dual use technologies as part of the review process of proposed **ManTech** projects. In light of decreasing DoD funds, the need to use those funds more efficiently, and the potential for duplication among DOD-funded programs, it is important for **DDR&E** to coordinate during the planning and review stages of the **ManTech** Program, to ensure that duplication does not occur, that technology developed within **ManTech** is

## **Implementation of ManTech Program**

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transferred and used by industry, and that opportunities for dual use are pursued to the fullest. Such efforts can be accomplished through an effective guidance and review process of **ManTech** projects.

## **Recommendations and Management Comments**

We recommend that the Director, Defense Research & Engineering:

1. Revise DoD Instruction 4200.15, "Manufacturing Technology Program" to:
  - a. Clearly define selection criteria for **ManTech** projects, including defining the terms "defense-essential" and "beyond normal risk of industry".
  - b. Clearly define the roles and responsibility of parties executing the **ManTech** program.
  - c. Establish performance metrics for reporting:
    - (1) Program results to demonstrate that the technology has in fact been transferred to private industry or used as intended.
    - (2) The status of projects from award to completion. The metrics should identify project milestones and accomplishments, and the actions to transfer results to industry with demonstrated benefits.
  - d. Include criteria for cost sharing that state what constitutes an acceptable in-kind contribution, documentation requirements for proof of cost contributions, and identifies the validation efforts taken to determine whether cost sharing goals have been met.
2. Strengthen the Joint Defense Manufacturing Technology Panel by:
  - a. Establishing an official charter for the Joint Defense Manufacturing Technology Panel.
  - b. Meeting quarterly and reviewing projects prior to award and execution for compliance with the Manufacturing Technology Program to eliminate duplication and ensure compliance with Manufacturing Technology goals and objectives.
  - c. Reviewing ongoing Manufacturing Technology projects to ensure that:
    - (1) Milestones are met.

**(2)** Benefits are realized.

**(3) Verify** that technology is transferred to industry.

d. Meeting with Director, Defense Research and Engineering, and ensuring that projects that do not comply with program goals are not provided funding until remedial actions are taken.

3. Review Centers of Excellence including sole-source justifications for those Centers of Excellence that have not been **recompeted** and require competition for future awards.

4. Establish a process for Military Departments and Defense Logistics Agency to transfer ongoing and completed project results to the Manufacturing Technology Information Analysis Center and verify that the Director of the Manufacturing Technology Information Analysis Center incorporates the information into the database of Manufacturing Technology projects.

**Management Comments.** The Director, Defense Research and Engineering, did not comment on a draft of this report. Therefore, we request written comments to the final report.

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## **Part II - Additional Information**

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## Appendix A. Audit Process

### Scope

We reviewed data from FY 1995 through FY 1997. We evaluated the policies and procedures of **DDR&E** and **DLA** for selecting, developing, and executing **ManTech** projects. We compared and analyzed the process for selection of the **ManTech** projects for determining the effectiveness of the program, and the transition of **ManTech** projects to industry. The audit did not rely on computer processed data. We interviewed responsible **DDR&E**, Military Departments, and **DLA** officials.

Projects were reviewed for adequacy of project justification, accountability of project cost and benefits, transition plan to industry, contract competition, and cost sharing. **CoEs** were reviewed for relevance to **ManTech** program, management and oversight, and accountability of project cost.

### Methodology

**Universe and Sample.** We judgmentally selected 21 projects and 10 centers of excellence from a sample of 97 projects and 17 centers of excellence. We derived our sample from various listings provided by each of the Military Departments and the Defense Logistics Agency stating **ManTech** projects and **CoEs** for FY 1996. Projects and **CoEs** were selected based on high dollar value and ensuring some representation from **DoD** organizations. **CoE**'s and projects selected represented approximately 24 percent of the FY 1996 budget.

**Audit Type, Dates, and Standards.** We conducted this economy and efficiency audit from February 1997 through October 1997, in accordance with auditing standards issued by the Comptroller General of the United States, as implemented by the Inspector General, **DoD**. We included such tests of management controls considered necessary.

**Contacts During the Audit,** We visited or contacted individuals and organizations within **DoD**, the General Accounting Office, contractor facilities, and various universities.

## **Management Control Program Review**

DoD Directive 5010.38, "Management Control Program," August 26, 1996, requires DoD organizations to implement a comprehensive system of management controls that provide reasonable assurance that programs are operating as intended and to evaluate the adequacy of controls.

**Scope of Review of Management Control Program.** We evaluated the adequacy of the DDR&E and the DLA management controls over the selection, management, and transition into industry of ManTech projects. In assessing those controls, we evaluated the plans, procedures, written policies, and management reviews.

**Adequacy of Management Controls.** The audit identified a material weakness. The policies and procedures governing the management of the ManTech Program were not adequate to ensure program objectives were being met. We identified a material management control weakness in the criteria for selecting projects for the ManTech Program. See Part I for details on the material weakness. The recommendations, if implemented, will improve the effectiveness of the ManTech Program. A copy of the report will be provided to the senior officials responsible for the management controls.

## **Prior Coverage**

GAO/NSIAD-92-74 (OSD Case No. 8923), "DoD's Manufacturing Technology Program Needs Systematic Evaluation," March 1992. The report states that the Office of Secretary of Defense did not have reasonable assurance that the ManTech Program is being effectively implemented. Long standing problems with the program's central management information system has gone uncorrected. Also, the program lacked goals and the cost savings benefits or financial benefit being attributed to ManTech projects are not reliable. The General Accounting Office recommended that the Secretary of Defense revise the ManTech guidance to demonstrate how the Military Departments program will be used to evaluate the overall ManTech Program and establish a system of controls designed to provide assurance that the ManTech Program is effectively implemented. Such a system should include guidance to ensure that the military Departments routinely and uniformly report on:

- the extent to which they have sound rationale to demonstrate they are funding projects that industry would not fund on a timely basis,
- the results of the projects measured against standardized criteria, and



- their progress in meeting established program goals, priorities, and planned approach.

The Secretary of Defense concurred with the recommendation to revise the guidance and partially concurred with establishing a system of controls. According to the Secretary of Defense, control problems can result from Congress earmarking funds for projects that have no benefit or cost effectiveness that is quantified.

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## **Appendix B. Report Distribution**

### **Office of the Secretary of Defense**

Under Secretary of Defense for Acquisition and Technology  
Director, Defense Logistics Studies and Exchange Information  
Director, Defense Research and Engineering

### **Department of the Army**

Auditor General, Department of the Army

### **Department of the Navy**

Assistant Secretary of the Navy (Financial Management and Comptroller)

### **Department of the Air Force**

Assistant Secretary of the Air Force (Financial Management and Comptroller)

### **Other Defense Organizations**

Director, Defense Logistics Agency  
Director, Defense Advanced Research Projects Agency

### **Non-Defense Federal Organizations and Individuals**

Senate Committee on Appropriations  
Senate Subcommittee on Defense, Committee on Appropriations  
Senate Committee on Armed Services  
Senate Committee on Governmental Affairs

**Non-Defense Federal Organizations and Individuals (cont'd)**

House Committee on Appropriations

House Subcommittee on National Security, Committee on Appropriations

House Committee on Government Reform and Oversight

House Subcommittee on Government Management, Information, and Technology,

Committee on Government Reform and Oversight

House Subcommittee on National Security, International Affairs, and Criminal Justice,

House Committee on National Security

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## **Audit Team Members**

The Contract Management Directorate, Office of the Assistant Inspector General for Auditing, DoD, produced this report.

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